File No. 53

19/4.

Collection No.

Mysore Residency

CB
9/7/47

Pros. Serial Nos. 1 – 4

Subject.

application to the C & M Station of the Musalman Wakf Validating Act VI of 1913

Previous References.	Later References.
J-149 A/09	F 83/23
F 136/13	F 83/24

Margin for binding not to be written on.

Office Note.

File No. 53/1914

S.1.

Letter No. 453 *dated the* 13th Feb.y 1914

from the District Judge, Ctm. station of Bangalore

SUBJECT.

Extension of the Mussalman Wakf Validating Act, 1913 (VI of 1913) to the Ctm. Station of Bangalore

The application of this Act to Ctm. Stati. seems desirable.

Draft letter to the Govt. of India with a draft notification is submitted for approval.

C.K.S. 19/2/'14

19/2

Rest.

May issue.

19/2

Issued no. 1341, Dated 21.2.14

S. 1. R. P. B.—11-1-11.—5,00

NOTES AND PRECIS.

S. 6.—R. P. B.—10-1911.—4,000.

Ml v.

R. P. B.—9-1909.—500.

No. 453

1168
19/2/14.

From

53/1914

THE DISTRICT COURT,

CIVIL AND MILITARY STATION,

Bangalore, 13th February 1914.

168

To

V. S. Tirumalacharlu Avergal, Esq., B.A.,
THE DISTRICT JUDGE,
CIVIL AND MILITARY STATION,
BANGALORE.

The First Assistant to the
Resident in Mysore

Sir,

I have the honour to recommend that the provisions of the Mussalman "Wakf" Validating Act, 1913 (Act VI of 1913) which declares the right of Mussalmans to make settled of property by way of "wakf" in favour of their families, children and descendants may be applied to the Civil and Military station of Bangalore. A draft notification is enclosed herewith for consideration.

I have the honour to be,
Sir,
your most obedient servant,

D. S. Tirumalacharlu
District Judge.

Draft.

1a

In exercise of the powers conferred by the Indian (Foreign Jurisdiction) Order in Council, 1902 and of all other powers enabling him in that behalf, the Governor-General in Council is pleased to direct that the following addition shall be made in the first schedule to the Notification of the Government of India in the Foreign Department, No. 7320, dated the 19th March 1913 applying certain enactments to the civil cantonment Military Station of Bangalore, namely:

After entry No. 85 the following shall be added, namely:-

85A The Musalman Wakf Validating Act, 1913 (Act VI of 1913)

Secretary to the Govt. of India

S.6.—R. P. B.—8-1913.—5,000.

2

H 52
1914.

[DRAFT.]

From

The Hon. Lieut. Col. Sir Hugh Daly
K.C.I.E, C.S.I.
Resident in Mysore

To

The Political Secretary to the Govt of
India.

No 1341 S—1
Foreign and Political Depts.
dt 21st February 1914.

Sir,

I have the honour to
~~application~~ extension
recommend the of the Mussalman Wakf
Validating Act, 1913 (VI of 1913),
to the C.&M. Station of Bangalore

2. ~~The proposed extension~~
~~is in my opinion desirable.~~
The necessary draft notification
is Enclosed for approval and
favour of publication in the
Gazette of India—

I have &c,

H. Daly.
Resident.

Sd 21/2/14

C.K.S.
19/2/'14

A.S.
19/2

B.B.—R. P. B.—8-1913.—5,000.

2
c

753
14

[DRAFT.]

From

Draft notification.

To

In exercise of the powers conferred by the Indian (Foreign Jurisdiction) Order in Council, 1902, and of all other powers enabling him in that behalf, the Governor General in Council is pleased to direct that the following addition shall be made in the First Schedule to the Notification of the Govt. of India in the Foreign Department, No. 782-D, dated the 19th March 1913, applying certain Enactments to the C.&M. Station of Bangalore, namely:—

After entry No. 85, the following shall be added, namely:—

"85-A. The Mussalman Wakf Validating Act, 1913 (VI of 1913).

AS 19/2/14 AS 19/2

No. 363-I.B.

A copy of the foregoing notification is forwarded to the Hon'ble the Resident in Mysore, for information, with reference to his letter No.1341, dated the 21st February 1914.

By order, etc.,

Under Secretary to the Government of India.

Foreign and Political Department,

S I M L A ;

The 12th M a r c h 1914.

(COPY)

No. 362- I.B.

Government of India.

FOREIGN AND POLITICAL DEPARTMENT.

Simla, the 12th March 1914.

NOTIFICATION.

In exercise of the powers conferred by the Indian (Foreign Jurisdiction) Order in Council, 1902, and of all other powers enabling him in that behalf, the Governor General in Council is pleased to direct that the following addition shall be made to the notification of the Government of India in the Foreign Department, No.732-D., dated the 19th March 1913, applying certain enactments to the Civil and Military Station of Bangalore, namely:-

In the First Schedule, after entry No.85, the following shall be inserted, namely:-

"85-A. The Mussalman Wakf Validating Act, 1913 (VI of 1913)."

Sd/- J. B. Wood,

Secretary to the Government of India.

No. 362-I. B.

Government of India.

FOREIGN AND POLITICAL DEPARMENT.

Simla, the 12th March 1914.

NOTIFICATION.

In exercise of the powers conferred by the Indian (Foreign Jurisdiction) Order in Council, 1902, and of all other powers enabling him in that behalf, the Governor-General in Council is pleased to direct that the following addition shall be made to the notification of the Government of India in the Foreign Department, No. 732-D., dated the 19th March 1913, applying certain enactments to the Civil and Military Station of Bangalore, namely:—

In the First Schedule, after entry No. 85, the following shall be inserted, namely:—

"85-A. The Mussalman Wakf Validating Act, 1913 (VI of 1913)."

(Sd.) J. B. WOOD,
Secretary to the Government of India.

R. P. B.—4-1914.—30.

S. 3.—R. P. B.—1-1913.—10,000.

753
1914.

[DRAFT.]

From

F. A. R

To [H.E. Notifn No. 362-J.B. of the 12th March 1914, from the Govt. of India, Foreign & Gol. Dept.]

No 1987 Enc. to S.3-

D/18 March 1914.

A copy of the foregoing notification is forwarded herewith to the Dist. Judge C.M. Station of Bangalore, for information with reference to his letter No. 453, dated the 13th February 1914.

S.I.

F. A. R.

C.A.S. 16/3/14

A.S. 16/3

Secy [illegible]

A

GLPP 13.3.47

Lil 13/3

File No. 25

1914.

Collection No.

Mysore Residency

Pros. Serial Nos. 1 — 3-7.

Subject.

General drainage scheme for the cantonment of Bangalore

Previous References.	Later References.
F 406/89 (1-25)	F 285/14
F 82/97	
F 286/99	
F 489A/05 (1-5)	
F 407/06	
F 121/13 (1-13)	

Margin for binding not to be written on.

Office Note.

File No. 85/14

8 C 1

Letter No. 783 *dated* 17th January C.J.

from C. O. C., Bangalore Brig

SUBJECT.

Scheme for the improvement of part of the Civil & Military station of B.

flag E

On the information given in sl: 241 of file 286 of 1899, the Govt gave a non-recurring grant

flag M.

of 4 lakhs (S. 249, file 286 of 1899) but there is nothing to show on what

S. 254 of 286/1899 flag N

the recurring grant of Rs 50,000/- has been made. It may be due to a recommendation of the Sanitary Comr after his visit to Bangalore, but his report has not yet come. The whole of the Rs 50000/ has been practically

S. 255 of 286/98

promised to the Municipality, and

@ S. 12-a of 121/1913 flag P

in the note on the revenues of the Bangalore Assigned Tract which, with

S. 10. C - 80

the approval of the C. of S, has been communicated to the Municipality, this recurring grant has been adverted

as one of the aids to the municipal commission.

Margin for binding not to be written on.

2. Under Foreign Depts notification No. 955 · I · A, of the 29th Dec 1899, issued under section 5 of the Bangalore Municipal Law certain buildings & lands have been said to be in the exclusive possession of the Military authorities. To these buildings & lands the provisions of the Bangalore Municipal Law ~~for~~ are not applicable. flag L.

3. In 1889 a Sanitary Board was instituted by the Resident, but it may be said to be defunct now. The Municipal Commission has a Health Committee, and there appears to be no objection to this Committee and the Military Sanitary Board collaborating in framing a scheme of sanitary reforms for the Civil & Military station. But before consulting the President of the Municipal S.10, 7 406/1889 flag K.

Margin binding must be written on.

Notes-continued

Commission, it would seem to be desirable to come to a decision as to whether the Military authorities are entitled to a share in the grant of Rs 50000 towards the cost of sanitary improvements in the areas within their exclusive possession. The reply would seem to be in the negation if the Rs 50,000/- is to come entirely out of Assigned Tract Revenues, but if a portion of it is to come out of Imperial Revenues the position becomes somewhat different. The G. of I. have not yet passed orders on the question of allocation of special grants.

For orders.

Asst
20/9/18
Regr.

This is a matter which might be discussed at a Thursday meeting. The general principle which should govern Col. Johnston's decision is, I think, sound. The Municipal Commission of the Mid. Contonments

S. 2.—R. P. B.—2.1913.—7,000.

Should Cantonments co-operate in Joint Sanitary Schemes
& I see no objection to the Pres[t], Resd[t] Surgeon &
Municipal Engineer discussing & corresponding with the A.C.R.E
& members of the Military Sanitary Board. In regard
to the grant of money; the Military have no claim. We
have no authority over or direct interest in Military lands
& if they want drainage for Sanitation they shd fight
their own battles. At the same time there is no reason
why we shd not help to some extent in schemes such
as at Bandstand (the limit of 6[0] st Pleasure) wh. to
some extent affect us.

MBL
21/1

If you see no objection, the signed copy of the d/o letter
below may go to Genl Wapshare.

21/I

Issue.

MBL
21/1

Issued W 504 of 21.1.14

Margin for binding not to be written on.

File No. 25/514

- 5/4

Office Note.

Letter No. 1452 dated 2-3-14

from Asst Director of Medical Services Bangalore & Southern Brigades.

SUBJECT.

General drainage scheme for the Cantonment of Bangalore.

A draft telegram submitted below for approval.

(After approval & issue drafts on para 5 of Resident's note will be submitted)

A.S. 3/3/14

Rest.

May issue.

MBW

Hon. (Not numbered a letter)

DS 4/3.

SLS Telegram issued 4.3.14

* Number added.

87 A draft D.O. to Mr Cox is submitted below for approval.

As regards increasing the capacity of the Hesarghatta Reservoir, please see

SL

H. 1. B. P. B.—3-1912.—5,000.

Sl: 259 file 45 of 1899 and the flag A
reply (flag B) to a reminder to the Durbar.
No report from the Durbar has yet
come & the last reminder issued on
the 17th February. The present agreement
expired in January last. Perhaps the S.82 flag C
Dewan may be spoken to. ds 4/3/14

Margin for binding not to be written on.

I spoke to the Dewan a day or two ago & told him that we might expect report shortly DJ 6/3

7-3-14

A.S. 4/3/14 Rest.

You might perhaps find an opportunity to speak to the Dewan about the case of the water works. Their last letter D/o Flag B, & I reminded on 17/2. Mr. Cox may issue. MBW 5/3

Telegram from the Secy, India, 520 C, dt the 7-3-14.

A draft is submitted below for approval.

A.S. 12/3 Rest.

May issue. MBW 13/3

Issued No. 1847 dt 13.3.14

Note continued

for
not
written
on.

Resident's minute on Office note on H.W. 3 of file
180 of 1914.

" Please let me know separately what
happened about the general drainage scheme."

IV
Se. W. 8

Please see our letter W. 1846 of the 13th
March 1914 to the President, Municipal
Commissioner, Coonoor Station. Probably a complete
survey with levels of the station is now being
made & a scheme for general drainage is
under preparation = If necessary, the President,
Municipal Commissioner, will be asked to
say how the matter stands at present.

H.
22/7/14

H.S.
22/7

Rest.

The matter has been temporarily shelved. It was,
as you remember, brought forward by Col. Johnston.
As a result of the Com^r. at Flag H. Mr. Cox asked
Col. Tate to approach the Madras Govt. as suggested
by General Bannerman. Col. Tate replied that the
had no money to spend on drainage & that as the
Municipality were going to undertake the scheme, they
should apply to Madras. Mr. Cox forwarded this (a
private letter) to me. I replied that (1) The Municipality
had no right to look for the help of the Madras
Sanitary Expert as the military had (2) The Madras Govt.

might well call on the Municipality to pay for the
Experts' advice (3) the Military had raised the question
a Joint Scheme & that they were not prepared to spend
any money on it as a help in the matter, there was not
much use in our combining with them (4) Mr Murphy was
on the point of going on leave so that we might wait
for his return by wh. time Col. Roberton's Scheme might
be forthcoming. I heard nothing further from Mr. Cox so
assumed that after consultation with Col. Tate the matter
was allowed to lie on. Mr. Murphy returns almost at
once from leave & it seems doubtful if Col. Roberton
will be able to give us a Scheme. I fancy he is now
on Special Duty in connection with the Aden Water-Supply
I still adhere to my opinion that if the Military are
unable to carry out their Share of a Joint Scheme
it will be useless to undertake one. If we did our Share,
it will be touched by the fact that the Military part was
not done.

MBW
23/7

Thanks. We can speak about
it some Monday. 28/7

Spoken.
No note. MBW
11/8

Marg. binding to be writt on.

Office Note.

File No.

Letter No. *dated*

from

SUBJECT.

Drainage scheme.

We spoke about this today. I explained the position & Mr Cox will now take up the question of getting a scheme prepared. He will again consult the military authorities as to their obtaining the advice of the Madras Sanitary Commissioner. I said that, if the Military authorities could not pay the charges entailed by a visit from the Sanitary Commr, Mr Cox should ask what the charges would amount to. I suppose they would merely be travelling allowances &, if the sum was inconsiderable, we might perhaps agree to meet it.

2. Major Standage said that some 15 years ago a very elaborate scheme for drainage was drawn up by Major de Lotbinie. Major Standage, who was then Health officer, wrote a long note on it. The scheme was for underground draiange & was not pursued; but Major Standage thinks that the plans, &c, which were prepared for it might be useful now. I do not remember ever seeing the scheme. Please put it up & note whether the Municipality have copies. If they have not, we should show our papers to Mr Cox.

19/I/1915.

Rest.

A copy of major de Lotbinière's report (with estimate) on the drainage of [illegible] is available with the Municipality. All the papers with regard to it are in the Municipal office.

19/1/15

Fly C
St. 36. File 82
.17

S. 1—E. F D.—2-10-14—10,000

10

Margin for binding not to be written on.

Mr Cox may as well see my note yesterday - He will be able to get hold of the plans, etc, & next week he can tell us what steps are being taken.

27/1

This file may perhaps be wanted for tomorrow's meeting

HF
25/1/15

No notes.
PBLO
26/1

To Mr Cox (440) No 4486 of 20-1-

Returned (up) to F.H.R. noted ars
21/1/15

Margin for binding not to be written on.

File No. 25/1914.

Office Note.

Letter No. *dated*

from

SUBJECT.

Drainage scheme.

(1) J. A. R's orders on the arrear lists.
"Put up file".

File submitted.
SLR 27/2/17 AS 27/2.

How does this case now stand?

Tm. 28 ii 17

flag N (2) Please see pages 7 to 10 of the office notes.

The matter ~~was~~ formed the subject of verbal discussions from which it would seem that Mr Cox was to have a scheme prepared. On the 25th January 1915 when the file was put up Mr Warburton, however, wrote "No Orders". Since then the file was not called for

AS 28/2 Issue & Do

Tm 6 iii 17.

S. 1.—S. P. B.—4-1914.—10,000

SLG Issued N (73) & S = 3.17

D.O. letter dated 6-3-17, from Asst. Collr. | 8210

may be filed & further communication may be awaited.

SLR 7/3/17 VBo 7/3

(3) Read: from (1)

I propose putting this file on the Reminder list and asking Revenue* how this case stands

Sd/- 8-iii-17.

* mark = 1st instance

Sd/- 10-iii-17

Approved

HVC 9.iii

D.O. Draft Remt. to the Collector submitted.

SLR 3.4.17

VBo 3/4

To issue after the holidays

Sd/- 5.4.17

Issued no. 2826 & 11.4.917

S. 11.

Letter No. 230, dated the 16th April 1917 from Mr. Cox

Submitted for orders - may be filed pro tem

KM 17.4.17 VBo. 19/4

Margin for binding not to be written on.

Notes—*continued*

Margin for binding not to be written on.

(4) Read.

Is any action necessary?

C. in 18.4.17

Residency Surgeon

Have we any remarks?

H.R.C.

18.iv.

(5) Reinault.

I am convinced that soon or later Bangalore, & other Indian towns, will have to face a Shortage of sweepers. Industrial enterprise is spreading fairly rapidly; and the sweeper class will find that more remunerative & enticing pleasanter work is to be found, in factories than in the drains & latrines of the towns.

This may not come in our time but it is certainly coming, and it behoves us to consider the best mechanical devices for the sanitary removal of sewage, & for the transformation of such sewage into a valuable & inoffensive manure.

Dr Fowler is perhaps, the first living effort on the biological disposal of sewage, and I am of opinion that the Municipal Commission would not be doing its duty towards their children, in future years, the responsibility of initiating a scientific system of sewage disposal will fall, if no record of his views is left to guide them.

S. 2—R. P. B.—6-1914—15,000.

It certainly seems impossible for the C.V.H. Station to entertain as a 15th table scheme, but I fancy all such schemes can be done piecemeal. At any rate we cannot tell how much or how little of the scheme can be undertaken until we have Dr Foster's views, and I certainly think they are worth the very moderate fee he asks.

The conservancy, as at present carried out, by bullock carts under a contract system, is far from ideal, and the manuring of fields in the surrounding county with crude, fresh night-soil, is far from sanitary - The reduction if even a small part of this nuisance would be something gained, and at any rate we would be on the right track. The question of the slaughter-house effluent is also an old trouble, and most important.

I think it as well that copies of notes I made in 1908 & 1910 for the then Municipal President should be on this file, and I attach them. They explain (attached) the position as it is at present & the various methods for dealing with it. It will be noted that as regards conservancy I advocate a septic tank system, which Dr Foster informs me is the one which he values at some £2000 in collaboration with Lt.Col Clemesha, Sanitary Commr, Bengal. He has since then elaborated the "activated sludge" method - which, I understand is more costly to instal but more remunerative as regards the value of the manure.

I strongly advise that Dr Foster's report should be asked for, and placed on record, and that he should give a comparative statement as regards the "activated sludge" method and septic tanks, with reference to (a) initial cost (b) cost of upkeep and (c) probable takings from sale of manure. He might also ask him for an opinion as to the feasibility of undertaking either method piecemeal

Rts

April 27. 17.

Rec'd. 2.5.17

Chas 7/6/17

Margin for binding not to be written on.

Notes—continued

Margin for binding not to be written on.

(6) M: Cox.

[illegible] on the foregoing notes.

For the reasons given by the Revising Barrister I am inclined to think that if the municipal Commission desire to obtain the views of any one who [illegible] Rs 1000 they will not be entitled to any thing, but, on the contrary, will be subject to the risk of disqualification.

It would be a good thing, if possible, to have the matter [illegible] the Commission, so that they may express their views thereon.

Yours &c.

3. V. '17

(7) FAR I am framing a resolution for the Commissioners' approval, to obtain sanction to payment of the fee mentioned. A copy of Cox's "remarks" dated 27/4/17 will be a useful addition to my file.

draft Do. submitted 10.5.17.

S. 2.—R. P. B.—2-1913.—7,000.

Margin for binding not to be written on.

Office Note.

File No. 25 1914

s. 14

Letter No. 1531, *dated* the 7th June 1917
from the President, Port Commrs.

SUBJECT.
Appropriation of the fee of Rs 1000/. 5% Bonds out of the recurring Sanitary grant.

flag O.

Please see para 7 of the office note.

A reference is invited to the office note* on Sl. 44 of 7 180/1914 with regard to the recurring Sanitary grant for 1917-18.

Submitted for orders.

CAS. 23/6/17 AG 28/6

S/

See my note on linked file. The file in question should be available in the municipal records.

23/6/17

See my note on linked file

15.7.17

* linked on this file.

Fee b-Rs 1000 a/cs Bonds
See file 180/14
H 15

Letter forwarded No 6869 S 6-7-17

Margin for binding not to be written on.

File No. 25 1914

Office Note.

Letter No. *dated*

from

SUBJECT.

Drainage Scheme

(1) Please see page 11 of office notes with Sls 1-13 and then Sl 15 (flag) in which a fee of Rs 1000/- was sanctioned for Dr Fowler to prepare a report on the Bangalore sewage question

flag O

A draft D.O. to Mr Tasker enquiring how the question stands is submitted below - with fair

(2) AS 26/1 Place on my next table. Will speak to Mr. Tasker meantime he comes to see me.

26/1

Spoken - draft below can issue.

19/2

S.18. .R.P B.—2-1914.—1 000

Issued no. 1322 dated 19th February 1918

Letter No. 7265, dated the 26th March 1918 / S. 19-
from the Resident, Municipal Commr

(3)

Please see Sl. 18.

The L. U. C. may be filed after
submitting to the Resident for information

C.A.S.
4/4/18

No
4/4

Resident

4/4

HVC
4.

Margin for binding not to be written on.

NOTES AND PRECIS.

S. 6.—R. P. B.—8-1914—1,000.

№ 783

Head Quarters
Bangalore 17th January 1914.

1914

349
From,
9.1.14 The General Officer Commanding
25/1914 Bangalore Brigade.

To,

The Honourable The Resident
in Mysore.

Sir,

S.254 9. 1914 28/1/99. With reference to the annual Sanitary grant of Rs50000 recently sanctioned by the Government of India for the Civil and Military Station Bangalore, I have the honour to address you on the above subject with a view to the collaboration of a scheme whereby the sanitary improvements, for sanction under the above grant, in the Military areas contiguous to the Civil areas in the Station, may be submitted for the opinion of the Civil Authorities and vice versa.

It is very desirable that some set scheme of sanitation should exist in a mixed Station under a dual control as the Civil and Military Station is, otherwise sanitary improvements in the Military area are very apt to clash with those within contiguous Civil area and vice versa.

For example I would bring to notice the insanitary area of that portion of the Civil and Military Station known as Baidu-halli, the contiguous portions of the Military and Civil areas of which require sanitary reforms which naturally would be met from the grant.

I am given to understand that the Civil Authorities are elaborating a scheme for this Civil area and it is my opinion

that the scheme should be collaborated with a joint scheme for sanitary reforms in both the contiguous portions of the Civil and Military areas and for such a joint scheme, the Military Sanitary Board should meet the Civil Sanitary Board to discuss the various reforms which are to be met from the Sanitary Grant for final approval for I presume that some of the Sanitary Grant of Rs50,000 is to be utilised for the insanitary areas under Military control that ~~be~~ lie contiguous to Civil areas.

I would be glad to be favoured with your views as regards the scheme for the appointment of a joint Sanitary Board for passing such sanitary reforms in the Civil and Military Station which are to be met from the Sanitary Grant which constitutes the basis of this representation.

I have the honour to be

Sir

Your obedient Servant

N. Wapshare,

Brigadier General

Commanding Bangalore Brigade..

about this

D.O. No 504

Mysore Residency

21st Janry 1914.

I am quite in accord with the general principles underlying your official letter No 783, of the 17th instant, regarding sanitation, &c.

The sanitary grant sanctioned by the Govt of India is in aid of the Municipality, who have of course no direct interest in the military lands within the station. There is, however, no reason why we on the civil side should not consider the propriety of helping, to a suitable extent, military schemes which affect the civil area; e.g. that connected with Baiduhalli; while it is certainly most desirable, as you say, to avoid risk of clashing.

It is my practice, when in Bangalore, to hold a meeting Tuesday mornings at noon, which is attended by the Residency Surgeon, the Collector, the A.C.R.E., & others. If it were convenient to you to attend, or to depute someone to do next Tuesday, we might have a preliminary & informal talk about this matter.

Yours sincerely

Sd/ H. Daly

(83-8.)

NOTE.

SUBJECT.

Question raised by General Wapshare as to assistance from special grants towards sanitation in military areas in the Civil and Military Station, Bangalore.

5.3

Colonel Johnston, I. M. S., attended our meeting this morning on behalf of the General. He had no special instructions. I explained that my view was that the grants to which the General had referred were made in aid of municipal revenues, and that no portion of them could be devoted to schemes in the military areas unless it were clearly shown that such schemes would be to the mutual benefit both of the municipality and of the military. Mr. Cox agreed that, on such proof being forthcoming, we might fairly consider some division of the cost of the schemes. We all agreed with General Wapshare's remarks as to the desirability of each party being kept informed by the other of any projects that were under consideration.

2. I mentioned that Major Robertson, I. M. S., Sanitary Commissioner with the Government of India, had laid great stress, when in Bangalore in 1912, on the importance of having one general and complete drainage scheme for the whole Station. He had told us that, in the absence of such a scheme, there was risk of waste in taking up the drainage of the Station piecemeal. Given a complete scheme, attention could be devoted to different parts of the Station, in accordance with the general principles of the scheme, in their order of urgency and as funds became available. Major Robertson had kindly promised to give us a complete scheme but, owing to pressure of work, he had not yet been able to send it to us.

3. Colonel Johnston said there was a sanitary expert at Madras whom the military authorities here were entitled to call in to advise. He suggested that this officer should be invited to visit Bangalore at an early date and to draw* up a general scheme in communication with the Municipal Health Officer and Executive Engineer. The scheme could then be sent to Major Robertson, for criticism. In view of the enquiries which he made and the information which he obtained when here, Major Robertson would probably be able to check the scheme effectively and quickly. Mr. Cox agreed with the suggestion and said he thought Dr. Amritaraj and Mr. Murphy were sufficiently acquainted with Major Robertson's views to draw up a scheme which would be likely to meet with his general approval.

I understand, though this was not definitely stated, that the scheme would be accompanied by a note showing the areas which it was first proposed to take in hand, in their order of urgency, and giving a rough estimate of the cost of the proposed work in each area.

4. Colonel Johnston and Mr. Cox had better see this note, to make sure that I have correctly stated their views. If they accept the note, it should then be shown to General Wapshare, to ascertain whether he agrees with the suggestions. Should he do so, I think that, before actually taking any definite steps, we had better telegraph to Major Robertson, explaining what we have in view and asking whether he has any remarks to make. It is some time since I last heard from Major Robertson. It is just possible that his promised scheme may now be well advanced, in which case we might wait for it.

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S. 4-

Memorandum No. 1452—Medical, dated the 2nd March 1914.

From—The Assistant Director of Medical Services, Bangalore and Southern Brigades.

To—The First Assistant Resident in Mysore.

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Dear Johnston,

Your D. O. dated 6th February 1914.

Under paragraph 1055, Civil Medical Code, quoted below, the military authorities can obtain the services of the Sanitary Commissioner for the inspection of the drainage of the Civil and Military Station of Bangalore on application to the Madras Government.

Yours sincerely,
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(3) Telegram to the Sanitary Commissioner with the Government of India No. 1552, dated the 4th March 1914.
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2. The scheme drawn up by the Executive Engineer and the Health Officer of the Municipality in consultation with the Sanitary Commissioner of Madras should be forwarded to this office for transmission to Major Robertson for his views.

No. 1847—Enc. 5, dated Bangalore, 13th March 1914.

A copy of the foregoing letter, with a copy of the papers quoted in paragraph 1 thereof, is forwarded herewith to the Assistant Director of Medical Services, Bangalore and Southern Brigades, with reference to his Memo No. 1452, dated the 2nd March 1914.

R. P. B.—3-1914.—60.

NOTE.

SUBJECT.

Question raised by General Wapshare as to assistance from special grants towards sanitation in military areas in the Civil and Military Station, Bangalore.

Colonel Johnston, I. M. S., attended our meeting this morning on behalf of the General. He had no special instructions. I explained that my view was that the grants to which the General had referred were made in aid of municipal revenues, and that no portion of them could be devoted to schemes in the military areas unless it were clearly shown that such schemes would be to the mutual benefit both of the municipality and of the military. Mr. Cox agreed that, on such proof being forthcoming, we might fairly consider some division of the cost of the schemes. We all agreed with General Wapshare's remarks as to the desirability of each party being kept informed by the other of any projects that were under consideration.

2. I mentioned that Major Robertson, I. M. S., Sanitary Commissioner with the Government of India, had laid great stress, when in Bangalore in 1912, on the importance of having one general and complete drainage scheme for the whole Station. He had told us that, in the absence of such a scheme, there was risk of waste in taking up the drainage of the Station piecemeal. Given a complete scheme, attention could be devoted to different parts of the Station, in accordance with the general principles of the scheme, in their order of urgency and as funds became available. Major Robertson had kindly promised to give us a complete scheme but, owing to pressure of work, he had not yet been able to send it to us.

3. Colonel Johnston said there was a sanitary expert at Madras whom the military authorities here were entitled to call in to advise. He suggested that this officer should be invited to visit Bangalore at an early date and to draw* up a general scheme in communication with the Municipal Health Officer and Executive Engineer. The scheme could then be sent to Major Robertson, for criticism. In view of the enquiries which he made and the information which he obtained when here, Major Robertson would probably be able to check the scheme effectively and quickly. Mr. Cox agreed with the suggestion and said he thought Dr. Amritaraj and Mr. Murphy were sufficiently acquainted with Major Robertson's views to draw up a scheme which would be likely to meet with his general approval.

I understand, though this was not definitely stated, that the scheme would be accompanied by a note showing the areas which it was first proposed to take in hand, in their order of urgency, and giving a rough estimate of the cost of the proposed work in each area.

4. Colonel Johnston and Mr. Cox had better see this note, to make sure that I have correctly stated their views. If they accept the note, it should then be shown to General Wapshare, to ascertain whether he agrees with the suggestions. Should he do so, I think that, before actually taking any definite steps, we had better telegraph to Major Robertson, explaining what we have in view and asking whether he has any remarks to make. It is some time since I last heard from Major Robertson. It is just possible that his promised scheme may now be well advanced, in which case we might wait for it.

5. Connected with the drainage scheme is the question of water for flushing &c. Two points camp up:—

(i) The Municipality are making certain experiments on wells, with the object of providing from them water for this and similar purposes. Mr. Cox might give us a brief note about this, showing what has been done and

*He thought this need not take more than about a week.

what the prospects are of being able to provide a good supply. Information such as this would no doubt be useful both to Major Robertson and to the suggested small committee, if it is convened.

(ii) Colonel Laurence said he understood the Durbar were considering definite proposals for raising the bund of the Hesarghatta Reservoir, so as to increase the reserve supply. If we do not know exactly how this matter stands, the Dewan might be asked demi-officially to tell us how the proposal stands and when any definite stage is likely to be reached.

6. Mr. Gover was the only officer present at the meeting to-day, in addition to Colonels Johnston and Laurence, Mr. Cox and myself.

27th January 1914. (Sd.) H. DALY.

Mr. Murphy tells me that Colonel Robertson did not inform either him or Dr. Amritaraj what his ideas were on the general drainage scheme. My statement therefore is not borne out by the actual facts. At the same time Mr. Murphy says that it would not take him very long to prepare, in consultation with Dr. Amritaraj, a general scheme without minute details for the 6 main sections into which the drainage scheme must necessarily be divided.

I think, however, that it would be better if they could wait for the assistance of the sanitary expert from Madras, and again these three might wait until we find out whether Colonel Robertson expects to send us his scheme soon.

3rd February 1914. (Sd.) A. R. COX.

NOTE.

My views were correctly stated by the Hon'ble the Resident and I would strongly recommend that a commissioned expert sanitary officer be consulted before any great scheme of drainage be undertaken for the Station. Probably Major Robertson would be greatly assisted in his final opinion if he had a scheme before him which was drawn up by the Sanitary Commissioner for Madras.

(Sd). C. A. JOHNSTON.

Memorandum No. 1452—Medical, dated the 2nd March 1914.

From—The Assistant Director of Medical Services, Bangalore and Southern Br'gades.

To—The First Assistant Resident in Mysore.

I beg to return the office note of the Hon'ble the Resident noted on by Lt.-Col. C. A. Johnston, I. M. S., Senior Medical Officer, Bangalore, who represented the General Officer Commanding, Bangalore Brigade, at the meeting of the 27th January 1914.

I also attach D. O. letter No. 40, from the Surgeon-General with the Government of Madras, stating that the services of the Sanitary Commissioner can be claimed for consultation. The General Officer Commanding quite agrees with the Hon'ble the Resident's note, and thinks that it should be ascertained by wire if Major Robertson has made out the scheme; otherwise the services of the Sanitary Commissioner, Madras, should be obtained.

D. O. No. 40.

Royapettah,
10th February 1914.

Dear Johnston,

Your D. O. dated 6th February 1914.

Under paragraph 1055, Civil Medical Code, quoted below, the military authorities can obtain the services of the Sanitary Commissioner for the inspection of the drainage of the Civil and Military Station of Bangalore on application to the Madras Government.

Yours sincerely,
(Sd). M. B. BANNERMAN.

1055. When local military authorities at any time seek from local Governments and Administrations the assistance or advice of the sanitary commissioner or the local civil district and medical officers regarding sanitation of cantonments, it should be freely given to them.

To—Lt.-Col. C. A. Johnston, I. M. S.,
C/o Assistant Director of Medical Services,
Bangalore and Southern Brigades, Bangalore.

Telegram No. 1552, dated the 4th March 1914.

From—The Hon'ble the Resident in Mysore.

To—The Sanitary Commissioner with the Government of India.

Your D. O. letter 54, 24th January 1913, Bangalore sanitation stop. General Officer Commanding suggests preparation of general and complete drainage scheme for whole Station including military areas by Sanitary Commissioner, Madras, in consultation with Municipal Health Officer and Executive Engineer of Station stop. Scheme would be sent to you for criticism stop. Please advise on this proposal stop. I presume you have not been able to complete your report.

Telegram No. 523 C., dated the 7th March 1914.

From—The Sanitary Commissioner with the Government of India.

To—The Resident in Mysore.

Your wire of fourth instant I have no objection to proposed preparation complete drainage scheme Bangalore stop. First requisite for this is complete survey of Civil and Military Station with levels stop. Regret have not been able complete sanitary report.

D. O. Letter No. 1836, dated the 13th March 1914.

From—The First Assistant to the Resident in Mysore.

To—The President, Municipal Commission, Civil and Military Station, Bangalore.

You will remember that at the meeting at the Residency on the 27th January, when the subject of drawing up a general drainage scheme for the whole Station was discussed, the question of water for flushing &c. arose, and that in this connection two points came up :—

(i) The Municipality are making certain experiments on wells, with the object of providing water for flushing and similar purposes. The Resident will be glad to have a brief note about this, showing what has been done and what the prospects are of a good supply. Information such as this would no doubt be useful both to Major Robertson and to the suggested small committee for drawing up a drainage scheme, if it is convened.

(ii) The Assistant Commanding Royal Engineer said he understood the Durbar were considering proposals for raising the bund of the Hesarghatta Reservoir, so as to increase the supply. This question is still pending with the Durbar.

No. 1846—Enc. 5, dated Bangalore, 13th March 1914.

From—P. B. Warburton, Esq., I. C. S., First Assistant to the Resident in Mysore.

To—The President, Municipal Commission, Civil and Military Station, Bangalore.

I am directed to forward herewith a copy of the papers noted on the margin on the subject of drawing up a general and complete drainage scheme for the whole of the Civil and Military Station of Bangalore, including the lands in the possession of the military authorities and to request that in consultation with the Assistant Director of Medical Services, Bangalore and Southern Brigades, you will arrange to obtain the advice of the Sanitary Commissioner with the Government of Madras. Before inviting this officer to visit Bangalore it seems desirable that, as suggested by Major Robertson, a complete survey, with levels, of the Station should be taken, if this is not already available.

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R. P. B.—3-1914.—60.

D. O. No: 737.

The Mysore Residency,

Bangalore, 5th March 1917.

From - F. R.

Dear Cox,

There is a pending file in my office called "drainage Scheme" and from it, it appears that a scheme should have been sent to us on the 25th January 1915!, and since then the file has been kept pending! . Is this the scheme that Standage has in hand or what?.

Yours sincerely,

Sd/- T. Ht. G. Tucker.

To

A. R. Cox Esq., I.C.S.,

Collector, C & M Station,

B a n g a l o r e.

SEWAGE TREATMENT.

ACTIVATED SLUDGE SYSTEM.

Description of Plant in operation
at the
CITY OF WORCESTER.

With the Compliments of
JONES & ATTWOOD, Ltd.,
STOURBRIDGE.

ɔoklet No. 52.

June, 1917.

SEWAGE TREATMENT.

ACTIVATED SLUDGE SYSTEM.

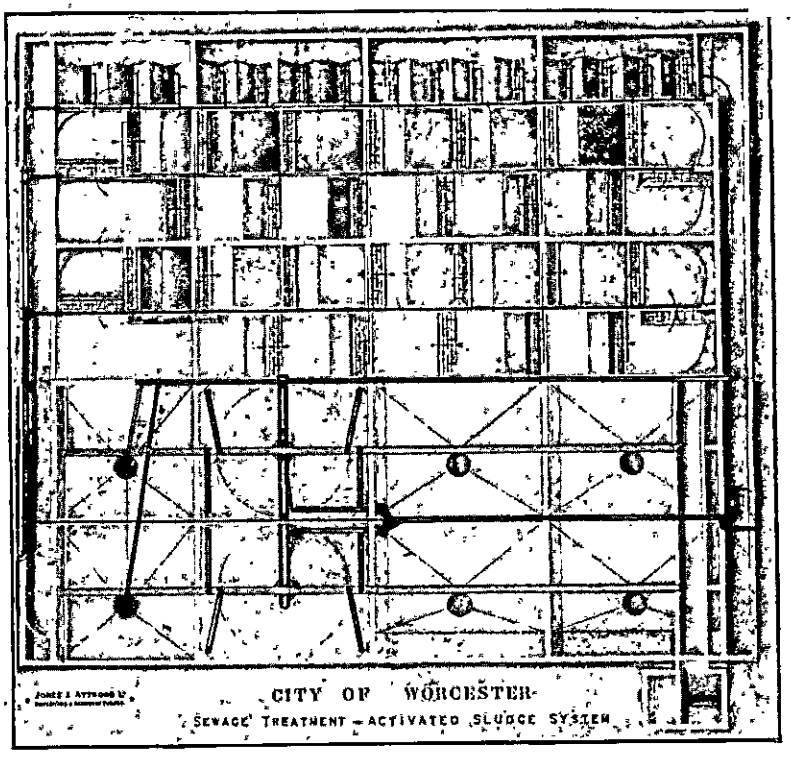
Description of Plant in operation at the CITY OF WORCESTER.

Messrs. JONES & ATTWOOD, Ltd.,
Patentees and Manufacturers,
STOURBRIDGE.

EVER since the attention of the City Engineer, Mr. Thomas Caink, was first called to the above process by Messrs. Ardern & Lockett's papers, he has exhibited a keen interest in it. As early as 1914 he conducted a deputation to Manchester and Salford to inspect their Activated Sludge plants, and was in communication with us on the same subject in December, 1914.

In May, 1915, we made suggestions for a small experimental plant in a tank of 10,000 gallons capacity (approx.) which proposal rapidly developed to a larger scheme in a tank of 500,000 gallons capacity.

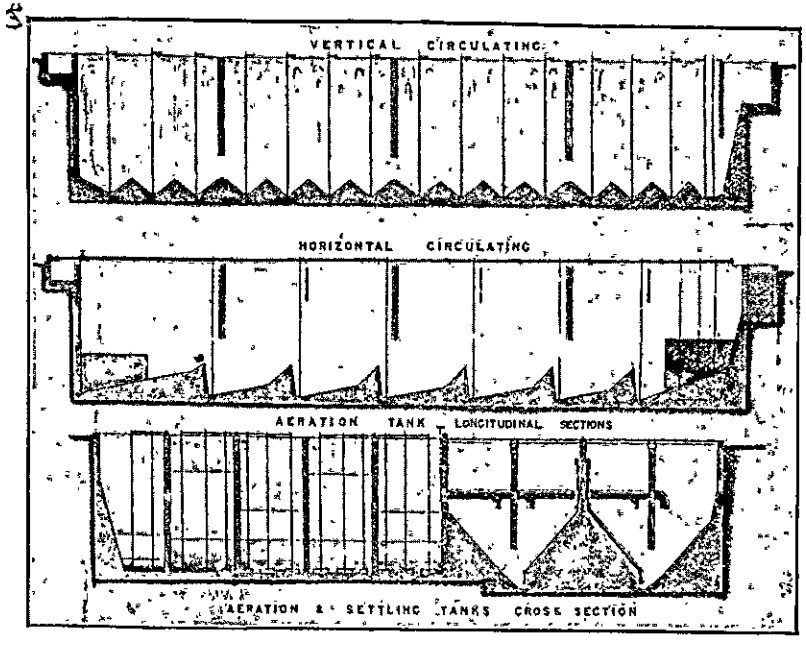
The Corporation decided that they were not themselves prepared to make experiments, but they offered us the use of one of their existing tanks for experimental purposes on certain conditions. On July 6th our proposals and estimate were submitted to Mr. Caink, who lost no time in submitting them to his Committee, for on July 21st we met the Committee, and after a



PLAN OF ABRATION AND SETTLEMENT TANKS.

full explanation of the scientific part of the process by Dr. Fowler, and an undertaking given by us verbally to accept all responsibility for the Engineering work, the Committee unanimously decided, and the Council subsequently confirmed that if we succeeded in treating 750,000 gallons of sewage per 24 hours, yielding a non-putressible effluent containing not more than four parts per 100,000 of suspended solids for 12 consecutive months, the Corporation would forthwith, upon the expiration of the trial period, take over and purchase the works and plant at an agreed price. If we failed to meet these conditions we were to remove the new works and restore the original tank, etc., to their previous conditions.

The alterations to the tanks commenced November 9th, 1915, but owing to war conditions and scarcity of labour progress was necessarily slow.



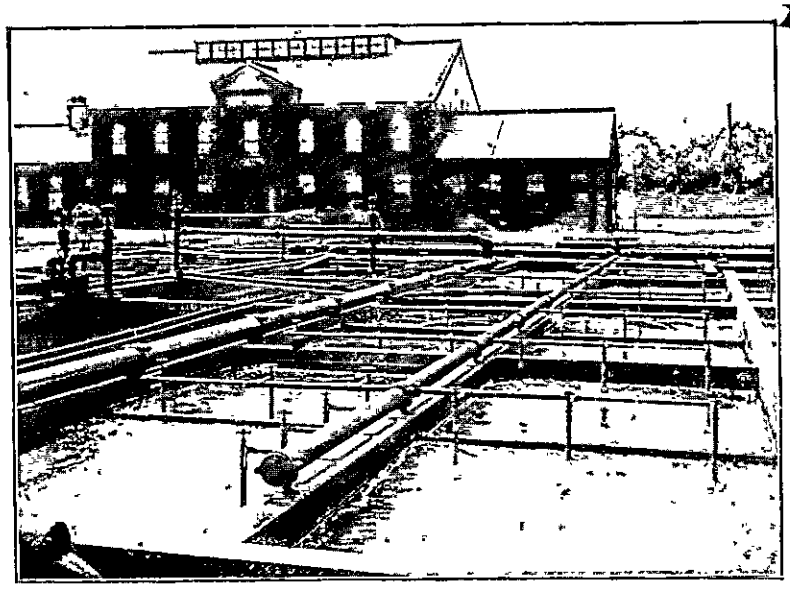
DESCRIPTION OF TANKS.

The tank placed at our disposal was 80ft. long by 72ft. wide, made up in 9 longitudinal bays each 8ft. wide with 9in. parting walls; these are again sub-divided into compartments with 9in. transverse walls. Of the 9 bays, 5 are used for aeration and agitation and 4 were adapted for settlement.

AERATION TANKS.

The five aeration bays are arranged as follows:—The first bay, though 8ft. broad at top, is only 5ft. at bottom, due to batter of outside wall. The bottom of this first bay is arranged with ridges and furrows 5ft. centre to centre, five air diffusers each 12in. square were placed at the bottom of each furrow. The lower part of each transverse wall is cut away, making an opening 3ft. deep right across tank above top of ridges, a ridge being arranged under each of these walls.

The other four aeration bays are arranged in pairs, each pair making a circulating tank. The bottoms of these circulating tanks are formed with ridges and furrows saw-tooth form at 10ft. pitch



LOOKING ALONG 4TH AND 5TH BAYS OF AERATION TANK FROM SEWAGE INLET CHANNEL INTO WHICH SLUDGE IS FLOWING.

with eight diffusers in each furrow. Advantage is taken of the transverse walls, which are used as baffles, and these together with intermediate baffles of wood give a baffle alongside each line of diffusers, which check the back flow and allow the rising current of sewage to flow forwards, thus giving a horizontal circulation of 100ft. per minute velocity, a circulation much more rapid than would be obtained by the natural flow of the sewage through the tank. The objects of this intensive circulation are to prevent the deposition of sludge and to secure equality of its diffusion.

SETTLEMENT TANKS.

To make the best use of the four bays for settling the sludge and drawing off a clear effluent, the aeration tank effluent was brought over a weir into a channel leading it to the end of the four bays, into which it flowed underneath a timber baffle about 8ft. below the surface, the liquid having a horizontal flow for a length of 80ft. over a floor area having slopes of 20 to 80 degrees from the horizontal, and finally flowing over the edges of, and into a concrete channel. Eight sumps were formed and fitted with 3in. dia. air lifts to lift the settled sludge into the inlet channel.

AIR COMPRESSING PLANT.

The Air Compressor, belt driven by Electric Motor capable of developing 40 B.H.P., is of the Ingersoll-Rand horizontal type, which when running at 235 r.p.m. has a piston displacement of 615 cubic feet, and an actual delivery of 562 cubic feet, or a volumetric efficiency of 91·5 per cent. at a pressure of 10lbs. per square inch. according to makers' test.—See " Running Costs," page 12.

AIR DISTRIBUTION.

The Air main is 9in. diameter from Compressor to aeration tanks, branching into one 4in. and two 5in. pipes, running full length of tanks with a separate branch 3in. diameter, reducing to 2in. for Air lifts. From the 5in. and 4in. dia. pipes the air is taken through w.i. galvanized pipes to the diffusers, set in the furrows of the aeration tank, and the air to each unit of 2 or 3 diffusers is controlled by a valve.

DIFFUSERS.

Considerable discussion has occurred in reference to the use of porous tiles for diffusing the air.

Before adopting the porous tile we tried some experiments with small orifices, but found they choked whereas porous tiles were apparently not affected to nearly the same extent.

Having decided on the use of porous material we spent many months during 1913 and 1914 testing every porous material obtainable without securing anything suitable, and finally decided to make our own, and since we found a satisfactory composition early in 1915 we have had no trouble in obtaining the required porosity, whilst the sludge is not easily drawn into the pores of the tiles although often subject to the full hydraulic head of sewage in tank, the tile acting as a filter.

Trouble was found during some of the earlier experiments at Davyhulme in oil choking the underside of diffusers, due chiefly to the fact that air was drawn from high pressure sources, and the oil used had become carbonised, but if air is compressed to not

more than about 10lbs. per square inch, the temperature of compression is not sufficient to alter the nature of the oil and thus the liability to choke is small, provided the air compressed is clean. A little oil probably prevents growths as we have found none. Our impression is that oil filters and traps are unnecessary, and one originally fixed at Worcester was removed after a few days' trial.

The following advantages of the porous tile diffusers for circulation over mechanical agitation fully justify their adoption.

(1) There are no moving parts in the Sewage.

(2) Compressed air is used for aeration, agitation, circulation and sludge lifting, one large power unit is more economical than several smaller ones.

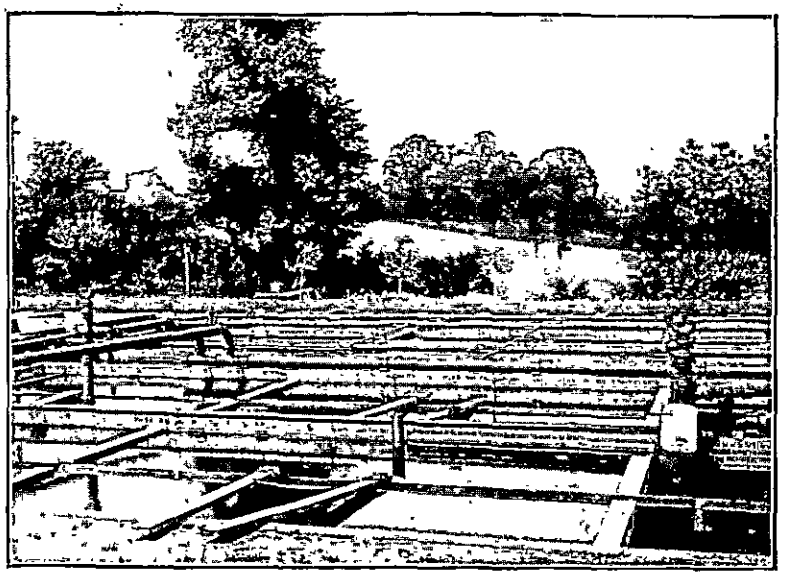
(3) The air used for aeration provides also for agitation and circulation.

(4) The vertical and lateral circulation by numerous diffusers in a ridge and furrow tank is more effective than any form of mechanical circulation. The sludge by means of the sloped bottom gravitates on to a diffuser, where it meets with an upward current of air and water and is carried rapidly to the top surface of the liquid, from which it falls slowly to be again carried to the surface. These numerous vertical whirl-pools ensure the whole of the sewage being equally treated.

(5) In most cases where compressed air is used all the heat of compression is lost, and only a portion of the potential energy in the cold air is obtained in useful work. In the use of compressed air for agitation and circulation the whole of the energy contained in the air is given back.

The reasons for this almost ideal efficiency of compressed air when used for aeration are :—

(a) There is no back pressure as the air escapes at surface of sewage at atmospheric pressure.



LOOKING ACROSS ACTIVATED SLUDGE TANK FROM SETTLING TANK.

(b) The energy in the air is used to produce motion in the liquid, and is therefore equivalent to the heat generated by that motion. Again, the work of the air expanding extracts an exact equivalent in heat from the liquid. Thus the two effects neutralise each other.

We reasoned that if air lifts are as economical as mechanical mixers, then the use of air for both mixing and aeration must make the air lift more economical.

We therefore concentrated our attention in devising the most economical method of agitating by air lifts and the outcome was the diffuser arranged in furrows.

It is interesting to find our reasoning has been borne out in practice, and that diffusers are being adopted almost without exception in the Activated Sludge Process.

Experience has proved that jets with holes of from $\frac{1}{32}$ to $\frac{1}{16}$ are at a disadvantage compared with diffusers, as they require several times the volume of air to give equal results in treatment.

PLANT IN OPERATION.

On April 6th, 1916, tanks and plant were complete, and treatment began on the "Fill-and-Draw" method, draw-off valves for this purpose having been fixed and the wall between aeration and settlement tanks timbered to allow of filling the aeration tank alone.

The average length of aeration for each filling was about 8½ hours. The sludge was built up rapidly and in 31 fillings of 8ft. 6in. depth each, the sludge amounted to 12½ per cent. of the full tank, this increase being at the rate of ·57 of one per cent. of volume of sewage treated per day, and after 16 days' operation the effluent had an oxygen absorption figure as low as 0·94.

On April 24th "Continuous Flow" treatment was begun at the rate of 700,000 gallons (112,000 cubic feet) per day, and the settlement tanks were filled and brought into commission, sludge being withdrawn from the first set of tanks and returned to sewage inlet channel.

After three days' operation the result is shewn by the following analysis :—

TABLE No. 1.

	Parts per 100,000.			
Date 1916	Character of liquid.	Free and saline ammonia	Albuminoid ammonia	Oxygen absorption 4 hours
27 Apr.	RAW SEWAGE average of 24 hours samples taken at intervals of 2 hours. Fairly clear; some dark flocculent sludge; no solids.	·92	1·8	2·21
27 Apr.	EFFLUENT Bright, clear; no solids, no smell; slight trace sludge.	·92	·084	1·34
Percentage of purification		Nil	95%	40%

This and other analyses shewed a falling off in results, the quantity of Activated Sludge in aeration tank having diminished seriously. Much of the returned sludge was found to be collecting in the sewage inlet channel. The sectional area of this channel was reduced and the consequent increase in velocity prevented the deposition.

Sludge was also deposited on some of the slopes of the settlement tanks, where it rapidly became septic, and it was decided on May 5th to alter these.

During the alterations the water level in aeration tank was dropped about 12ft. and the sludge kept active by daily aeration. This alteration was completed May 28th, and after treating 200,000 gallons (32,000 cubic feet) of sewage on the 29th while treating 250,000 gallons (40,000 cublic feet) on the 30th an analysis of the effluent gave the following :—

TABLE No. 2.

	Result in parts per 100,000.			
Date 1916	Character of Liquid.	Free and saline ammonia.	Albuminoid ammonia.	Oxygen absorption 4 hours.
May 30	Average raw 24 hours sewage, Opalescent; brown solids strong smell	2·48	·46	4·8
May 30	EFFLUENT. Clear bright: and smell; very few light solids.	1·38	·009	·58
Percentage of purification		44%	98%	88%

The volume treated was gradually increased to 800,000 gallons (128,000 cubic feet) per day, when a sample was analysed with the following results :—

June 9	EFFLUENT	·6	·13	·4

Nitrogen in nitrates and nitrites 1·3.
Dissolved atmospheric oxygen absorbed in five days, 0·8 parts.

On the 5th July, when treating 830,000 gallons (133,000 cubic feet) per day, the analysis of a sample yielded the following result:—

TABLE No. 3.

Date	Character of liquid.	Parts per 100,000			Percentage of purification
		Free and saline ammonia	Albuminoid ammonia	Oxygen absorption 4 hours	
5 July	SCREENED SEWAGE Opalescent; some sludge; strong smell; no solids	3·2	·60	5·7	—
5 July	Partially treated Sewage at end of 1st bay. Very slightly opalescent; some sludge; no solids; faint smell	2·00	·19	1·98	Albuminoid ammonia 68% Oxygen absorption 66%
5 July	EFFLUENT after 1st settlement, clear, bright; some sludge; no solids; no smell	—	—	·68	Oxygen absorption 88%

Proportion of sludge in aeration tank = 16 per cent.

Treatment was continued with slight interruptions (for enlarging the air lifts from 3in. to 6in., and fixing effluent collecting troughs) until December, 1916, at rates varying from 600,000 to 1,000,000 gallons (96,000 to 160,000 cubic feet) per day, but the first set of settling tanks in which all the settling was done was not able to pass continuously and successfully more than 750,000 gallons (120,000 cubic feet) per day of sewage, or including returned sludge, 1,000,000 gallons (160,000 cubic feet). Their capacity being 30,000 gallons (4,800 cubic feet), they afforded 57 minutes flow calculated on the 750,000 gallons (120,000 cubic feet) daily flow, or 43 minutes calculated on the total of 1,000,000 gallons (160,000 cubic feet).

The 6in. air lifts together were set to raise 250,000 gallons (40,000 cubic feet) per day of sludge, but are capable of raising up to 400,000 gallons by further opening of the compressed air valves.

During a week's test from 20th to 27th October with a fairly constant flow of 750,000 gallons (120,000 cubic feet) per day of sewage, the average of suspended solids in the effluent was 3·4 parts and the oxygen absorbed in 4 hours test 1·13 parts per 100,000 results well within the requirements of the City. The proportion of Activated Sludge in a sample of sewage taken from the Aeration Tank and settled for one hour in a glass cylinder amounted to 11 per cent. at beginning, and 15 per cent. at end of the week's test, all sludge during the week being returned to Aeration Tank.

As the Aeration tank appeared capable of treating much larger quantities, and that not more than 750,000 gallons (120,000 cubic feet) of sewage per day could be settled in the first set of settling tanks if the suspended solids in effluent were to be kept down below 4 parts per 100,000, it was decided to alter the slopes of the second set of tanks and utilize them in the same way. This has now been done, affording an extra capacity of 40,000 gallons (6,400 cubic feet) for settling purposes.

It is interesting to note that no trouble had or has been experienced in connection with the aeration tank, which from the start has given excellent results, so that almost all alterations have been in connection with the settlement tanks to make them capable of dealing with the flow from the aeration tanks.

PURIFICATION OBTAINED.

The average of nine samples of Screened Sewage being all those taken and analysed by the Worcester City Analyst between July 1916 and 19th May 1917 gave the following results in parts per 100,000.

Solids in Suspension	14·3
„ Solution	128·8
Albuminoid ammonia	·76
Oxygen absorbed in 4 hours ...	3·7

Since November, however, the more dilute sewage from the St. John's district has been omitted and a snap sample taken 22nd May last of Worcester City Sewage showed the oxygen absorbed figure to be as high as 9·74 and the albuminoid ammonia 1·48 parts.

The following are results of analyses taken by the Worcester City Analyst of samples of final effluent, which fairly represent the process in operation. during the last 12 months, the average volume of sewage treated per day being 757,000 gallons.

TABLE No. 4—parts per 100,000.

Date	Sample	Solids in Suspension	Albuminoid Ammonia	Oxygen absorbed in 4 hours
1916				
June 9	Snap	Nil	·13	·4
,, 19	,,	,,	·15	·4
,, 20	,,	1·2	·13	·5
July 4	24 hrs	3·8	·13	·8
,, 6	Snap	1·0	·13	·4
,, 14	24 hrs	1·2	·17	·5
,, 19	,,	Nil	·1	·6
,, 27	,,	1·0	·2	·6
Oct. 17	,,	Nil	·12	·7
Nov. 22	,,	Nil	·16	·8
,, 27	,,	Nil	·07	·4
1917				
May 18	,,	·4	·21	·5
	Average	·72	·14	·56

The sludge in aeration tank on the above dates averaged 19% as measured in a glass cylinder after one hour's settlement.

Only two samples of effluent taken during the last 12 months shewed any putrefaction after five days and these were taken last October and contained large proportions of sludge which was not settled out until the tankage was increased.

RUNNING COSTS.

To give the necessary agitation it was found possible to reduce the compressor speed to 160 R.P.M. giving a free air delivery of 384 cu. ft. per min. at an absorption of 20 B.H.P.

The surface area of Aeration Tank is 3,280 square feet, hence seven cubic feet of air is used per square foot of tank surface per hour, including that used by air lifts.

Readings, confirmed by Mr. Lamb, the Sewage Works Manager, show that the Electric Motor absorbs 16 units per hour at ¾d. per unit=1/- per hour for power, hence the greater the

volume of sewage treated (which will depend upon the strength of the sewage) the less the cost per million gallons. This would follow in a sliding scale as shown in

TABLE No. 5.

Rate of flow per 24 hours.		Electrical Units used, and cost per hour.		Cost per Million Imperial Gallons at ¾d. per unit.
Imp. Galls	Cubic Ft.	Units.	Cost.	
750,000	120,000	16	1/-	32/-
1,000,000	160,000	,,	,,	24/-
1,250,000	200,000	,,	,,	19/3
1,500,000	240,000	,,	,,	16/-
1,750,000	280,000	,,	,,	13/9
2,000,000	320,000	,,	,,	12/-

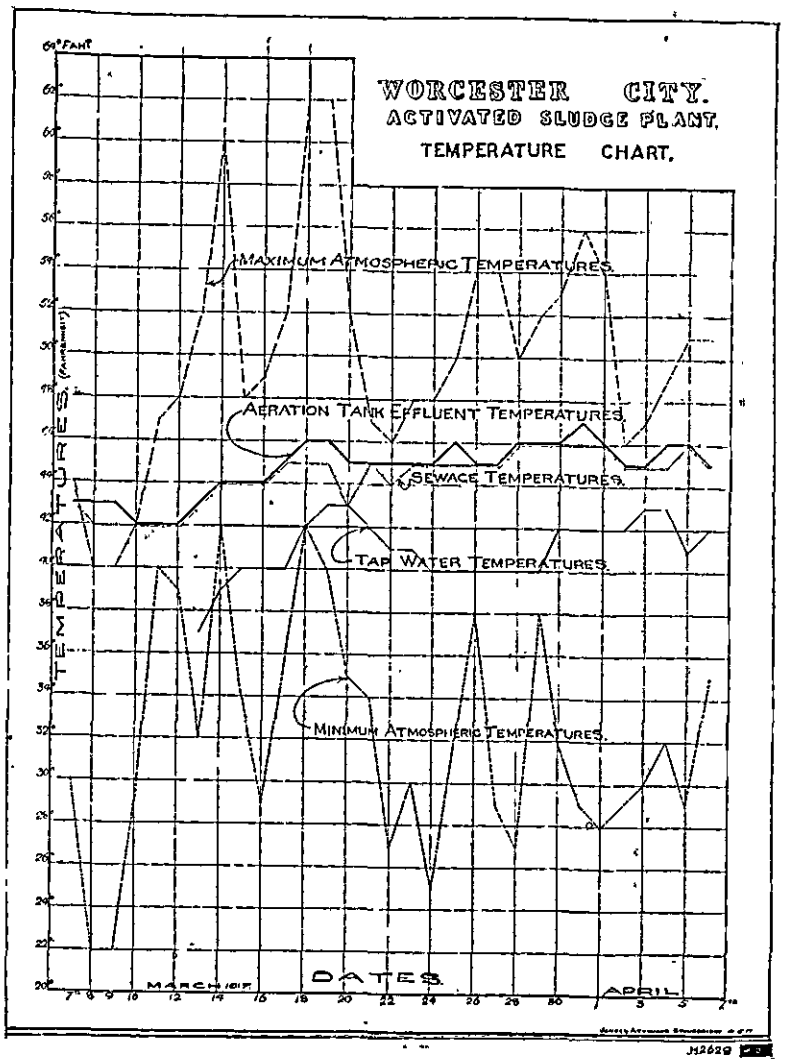
The volume treated up to date has varied from 700,000 to 1,500,000, but we are of opinion that a still larger volume can be treated efficiently, in which case the cost per million gallons would be proportionately reduced.

The average B.H.P. for lifting the sewage from present tanks at Worcester into the tower (for distribution on filters by means of the pipe arm distributors) was 25 B.H.P. per million gallons, but this lift is now unnecessary and its cost is entirely saved

Thus when treating 1,500,000 gallons (240,000 cubic fee) per day with 20 B.H.P. (14 B.H.P. per million gallons) there is a saving in electricity for working plant of 44 per cent., the maintenance of the distributors and primary filters amounting to £1,100 per annum is saved, also that of the sand filters, and a better effluent is obtained.

TEMPERATURES.

The temperature diagram shown herewith is of especial interest as the temperatures were taken during a spell of cold weather, the lowest atmospheric temperature recorded is 22°F, or as low as usually experienced in a normal English winter.



It will be noticed that the temperature of the sewage was always higher than the temperature of the tap water, averaging 4°F higher, and that the temperature of the effluent after aeration was never lower than that of the sewage, but on eight days it was actually higher. It will also be noticed that the greatest difference between the tap water and sewage temperature was during the coldest weather.

The diagram explains why spells of cold weather do not affect the character of the effluent materially, and further gives reason to expect that the process will be found more suitable for cold climates than exposed trickling filters.

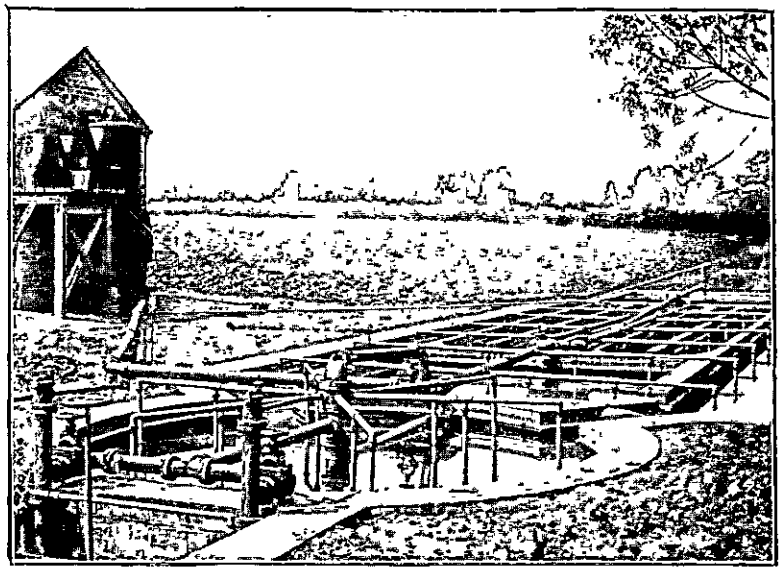
PULSATING GEAR.

Since the plant at Worcester was designed we have brought out an important improvement in the method of applying the compressed air, our patent pulsating gear applies the air in intermittent puffs, and this has been tested at the Manchester Sewage Works, Davyhulme, and shows a reduction in the volume of air required of about 50 per cent. The pulsating valves are of simple mushroom type, each operated by a pressure diaphragm receiving its air pressure intermittently from one of a series of pilot valves, the series being operated from a cam shaft which is turned by an air wheel immersed in oil. Each pilot valve controls the air to a definite section of the Aeration Tank There may be two or more sections. If there are six sections then one is being blown vigorously for say five seconds, during the five seconds the sewage and sludge in this section is thoroughly agitated so that even the heaviest sludge is blown to the surface, and this being repeated every 30 seconds keeps the liquid and sludge in constant circulation.

This intermittent blowing has other advantages. The concentration of the air on a smaller number of diffusers brings a larger number of the small pores of each diffuser into commission, thus keeping them open and dividing the air used into a larger number of small bubbles. If during the puff twice the amount of air is blown through a section of diffusers, yet with six sections only one third the total volume of air is required that would be used blowing continuously.

Intermittent blowing at frequent intervals of lines of diffusers interspersed throughout the tank ensures a better general circulation, and at same time prevents any local action. This effect is greatly increased by using a sufficient volume of air to compel any deposited sludge to be carried up to the surface. Sludge thus raised travels for a short distance over the surface, and then gradually falls depositing on another set of diffusers not blowing

at the time from which it is again raised to the surface. This intermittent action operates in a cycle of about 30 seconds duration.



ACTIVATED SLUDGE PLANT AT BLACKPOLE, NR. WORCESTER, TREATING 30,000 GALLONS PER DAY.

The following list gives some particulars of our Activated Sludge Plants already complete or nearing completion.

TABLE No. 6.

	Capacity of Aeration tanks.		Volume actually treated.		
Place.	Imp. galls.	Cubic ft.	Imp. galls.	Cubic ft.	Operation.
Worcester	317,000	49,920	1,500,000	240,000	Continuous.
Stamford	43,700	6,992	100,000	16,000	Continuous.
Baguley	8,800	1,408	20,000	3,200	Fill and Draw
Davyhulme	15,400	2,624	30,000	4,800	Fill and Draw
Government Factory	4,700	752	14,000	2,240	Continuous
Government Factory	15,600	2,400	30,000	4,800	ditto.
Withington	57,000	9,120	—	—	ditto.

PATENTS.

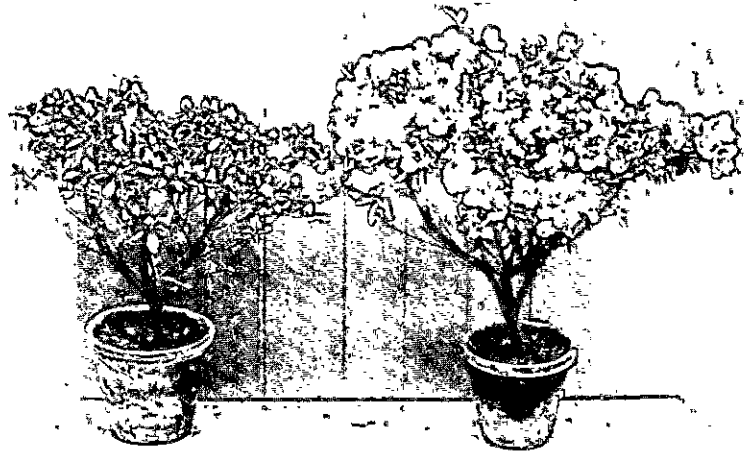
As stated in our Booklet No. 49, Page 4, the object of our patents is :—

"To secure for the pioneers some control over the development of the process, and thus ensure the success of every installation."

There is no intention to restrict or retard the development of the Activated Sludge Process by our patents. We are in touch with many useful experiments treating all kinds of sewage and progress is continuous, much expenditure on repeat experiments which would occur with numerous workers operating on the same lines being avoided.

Our association with the University through the Frankland Laboratory at Manchester and Mr. Ernest Gaul, M.Sc., the successor of Dr. Fowler, ensures scientific control and development.

To enable development to proceed in America free from the effects of the war, Professor Fowler gave Mr. Chalkley Hatton valuable advice in reference to his Milwaukee experiments, and we on our part designed a tank which we understand Mr. Hatton built to our designs. We further sent him our ideas as to continuous tanks. The outcome of Professor Fowler's foresight in giving every possible help to Mr. Chalkley Hatton, and this gentleman's enterprise with ample means for experiment at his disposal, have made the process very popular in America.



UNTREATED. TREATED.
WITH ACTIVATED SLUDGE.

To shew the availability of the nitrogen in activated sludge, two equal plots, "A" and "B" were prepared near Manchester, "A" with activated sludge in powder form and "B" with farmyard manure. Calculating the amount of nitrogen in farmyard manure to be ·5%, activated sludge was added to plot "A" in quantities containing as nearly as possible the equivalent amount of nitrogen and in both were set an equal number of seed potatoes. Plot "A" yielded 150 lbs. and plot "B" 62 lbs. of potatoes. These particulars were reported to us by Mr. Ernest Gaul, M.Sc.

We also tried activated sludge on various horticultural plants, azalias, calceolaries, cinnerarias, francoes (bridle wreaths), hydrangeas, marguerites, spireas, etc., and as shown by a number of photos the results were very encouraging, see illustration of azalea plants, page 17, soil top dressed January 18th, photo taken March 31st, 1917, and note the difference in blooms and foliage.

The general effects produced were that:—

The plants became strong, healthy and vigorous, with a bright rich foliage.

The buds and blossoms show earlier, and in increased numbers.

The blooms are larger, brighter, more numerous and mature four or five weeks earlier.

This important branch of the development is in expert hands, and we believe it will eventually lead to a satisfactory solution of the sewage sludge difficulty, and yield a valuable return.